

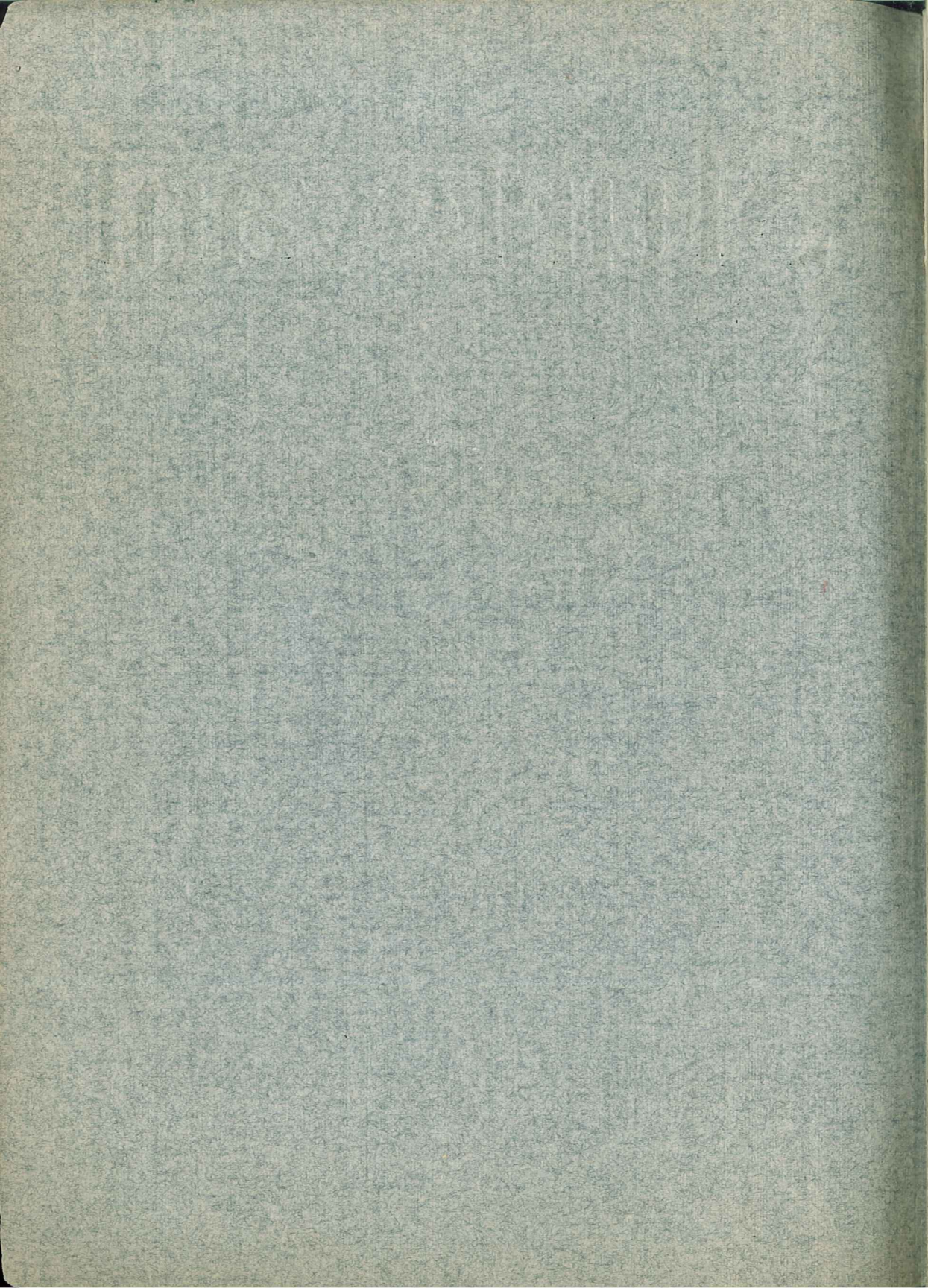
Nov. 1927.

Sturtevant

FUEL ECONOMIZERS
& AIR HEATERS



CATALOG No. 150



Sturtevant

FUEL ECONOMIZERS AND AIR HEATERS

STURTEVANT ENGINEERING SERIES
CATALOGUE NUMBER 150

SECOND EDITION
JULY 1911

B. F. STURTEVANT CO.

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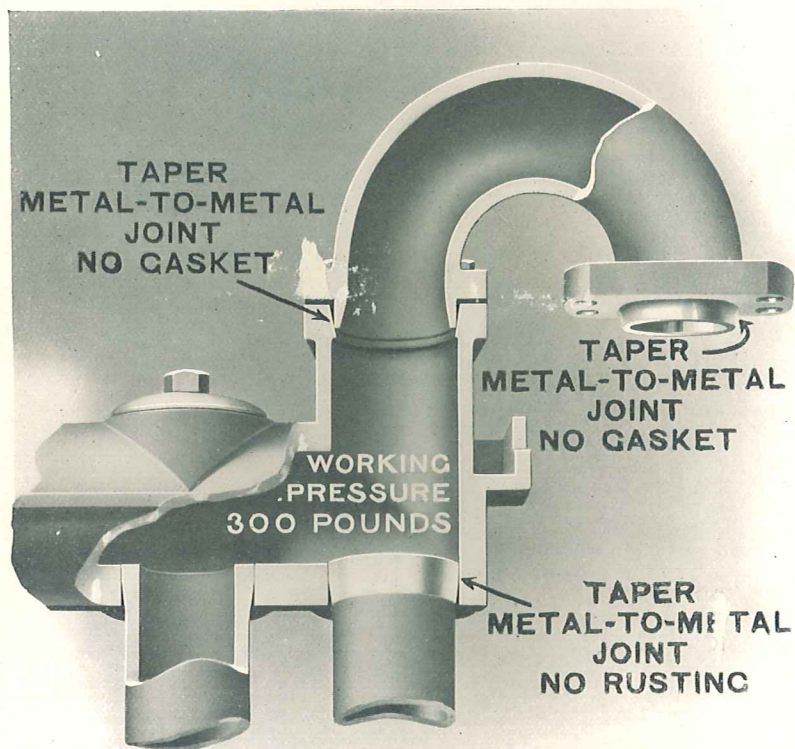
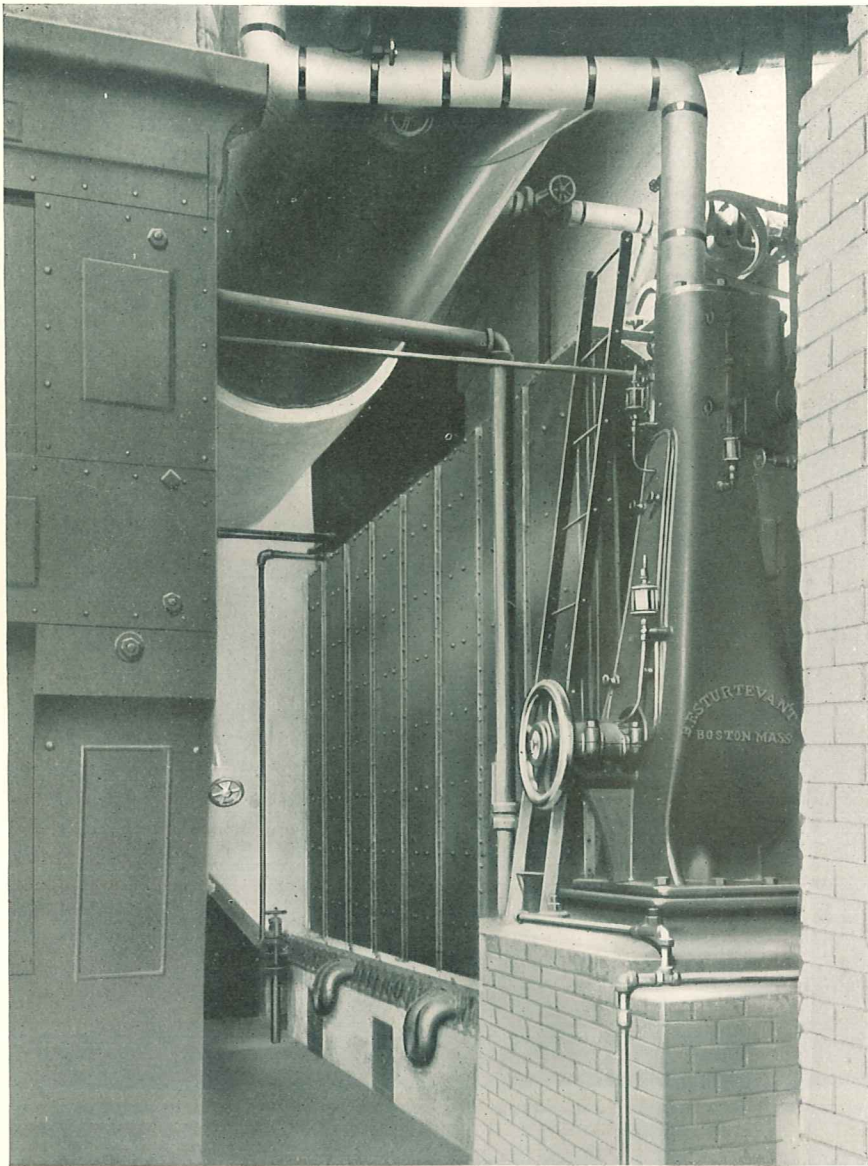


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ECONOMIZER AT THE NORFOLK AND NEW BRUNSWICK HOSIERY CO.

STURTEVANT FUEL ECONOMIZERS

The principle of the Sturtevant Economizer is to conduct the hot waste gases which have passed through the boilers and are escaping into the chimney around and between a system of cast-iron pipes containing feed water, thus heating a large volume of feed water to a high temperature before it enters the boilers, accomplishing all this saving in fuel and gaining this extra boiler capacity by the use of otherwise wasted gases.

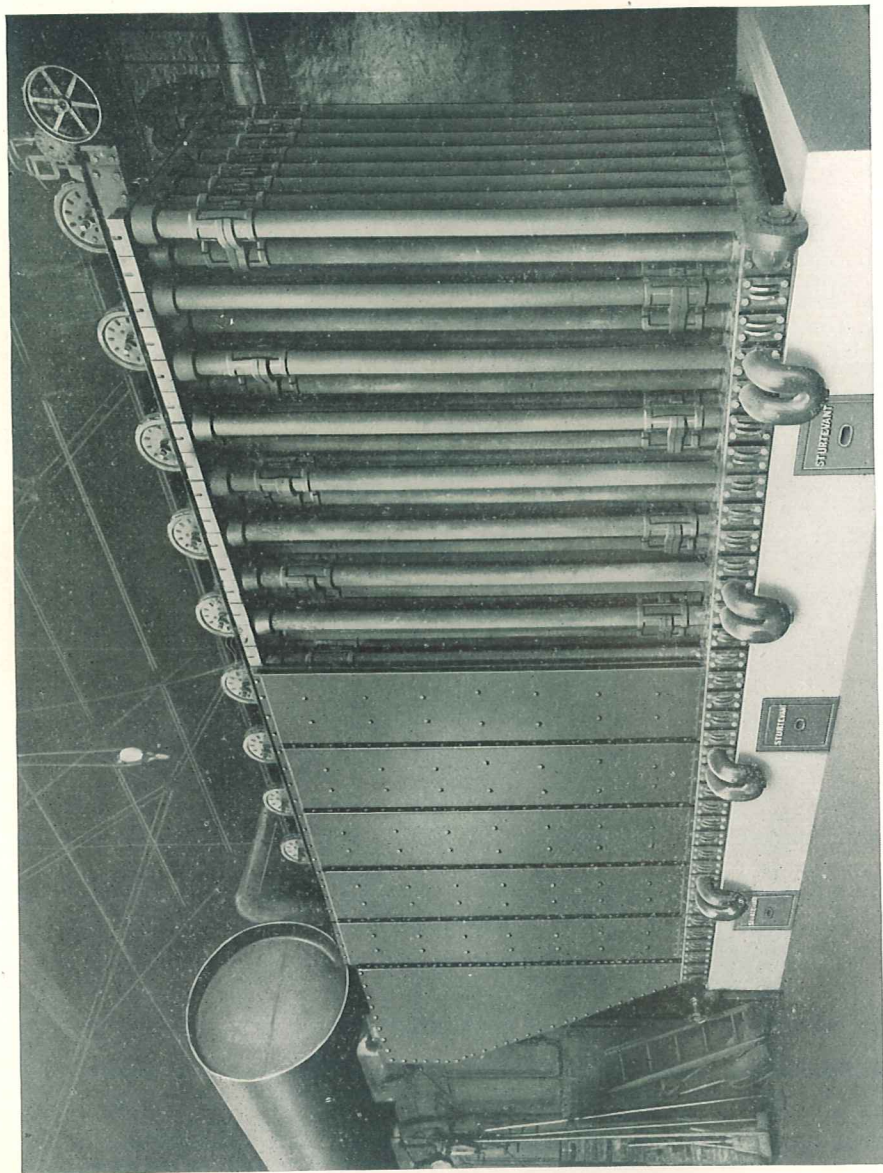


WHAT THE STURTEVANT ECONOMIZER DOES

It saves 10 to 20 per cent in fuel by supplying the boiler with water
SAVES FUEL almost to the boiling point, thus saving the coal necessary to heat cold feed water.

It increases the boiler capacity 20 to 40 per cent, as the large
INCREASES reserve of hot feed water, always ready in the
BOILER economizer, leaves the boilers only the work of
CAPACITY bringing the hot water to the vaporizing point.
This enables the boiler to convert much more water into steam when aided by an economizer.

By heating the feed water the boiler gets none of the sudden expansion and contraction due to the change of temperature when cold
REDUCES water is fed, thus avoiding many leaks and pro-
REPAIRS longing the life of the boiler. The purifying of the water by lessening the scale increases the durability of the boilers as a whole by reducing the tendency to bag.



ECONOMIZER AT THE CLEVELAND CLIFFS IRON CO.

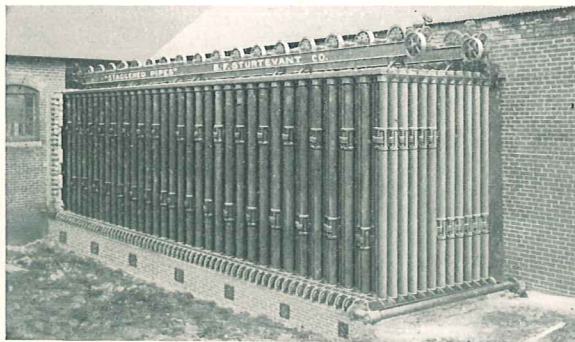
STURTEVANT FUEL ECONOMIZERS

The feed water is purified by heating in the economizer, and in circulating through the economizer pipes a large part of the impurities settle into a section which is easily cleaned out. This gives purer water to the boilers, reducing the amount of scale and allowing the boilers to steam much more freely.

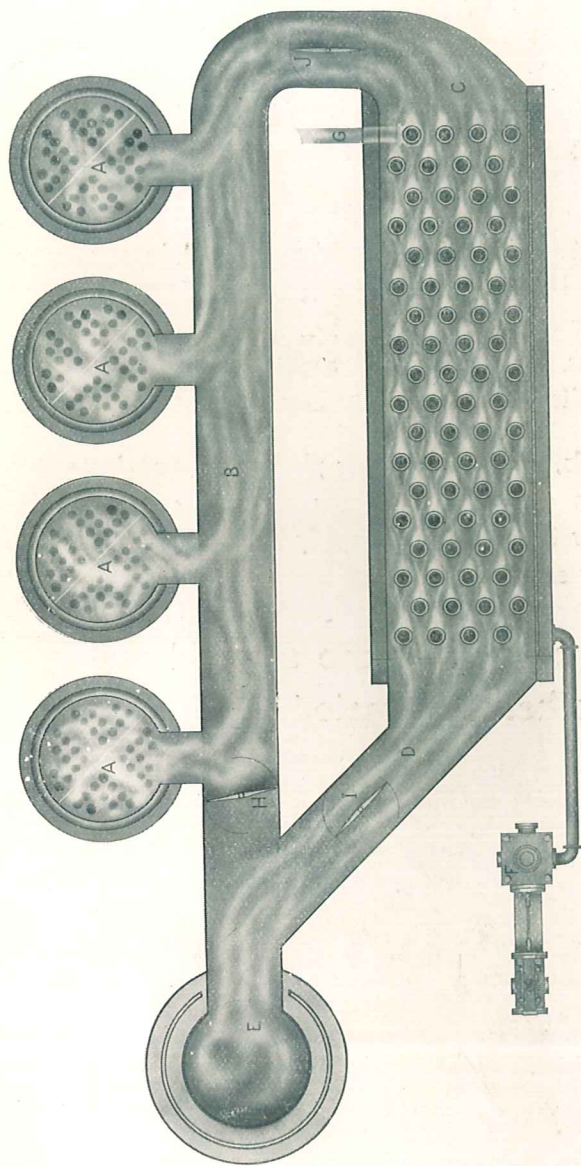
It reduces the amount of soot in the chimney and lessens smoke from the stack, as the hot gases in passing through the economizer deposit a large amount of soot on the economizer pipes. This soot is automatically scraped from these pipes and deposited in a soot chamber under the economizer.

Textile mills, paper mills, and many other plants needing large quantities of hot water in processes of manufacture draw this from the supply in the economizer, thus getting their hot water at no fuel cost.

All these savings are secured
from otherwise wasted gases.



**ECONOMIZER AT INTERNATIONAL PAPER CO., RUMFORD FALLS, ME.
BEFORE ENCLOSING**



The hot gases leave the boilers A, pass through flue B, and enter the economizer casing at C. The gases then pass by and around the economizer pipes filled with feed water, heating the water to a high temperature. After reducing their heat in raising the temperature of the feed water the gases pass through flue D to chimney E. The feed water from pump F passes through the economizer pipes and enters the boilers through pipe G, having been greatly raised in temperature by the impinging hot gases. H is the by-pass damper which compels gases to go through economizer. I and J are dampers by shutting which and opening H the gases can be passed directly to the chimney.

STURTEVANT FUEL ECONOMIZERS

SAVING EFFECTED WITH ECONOMIZERS

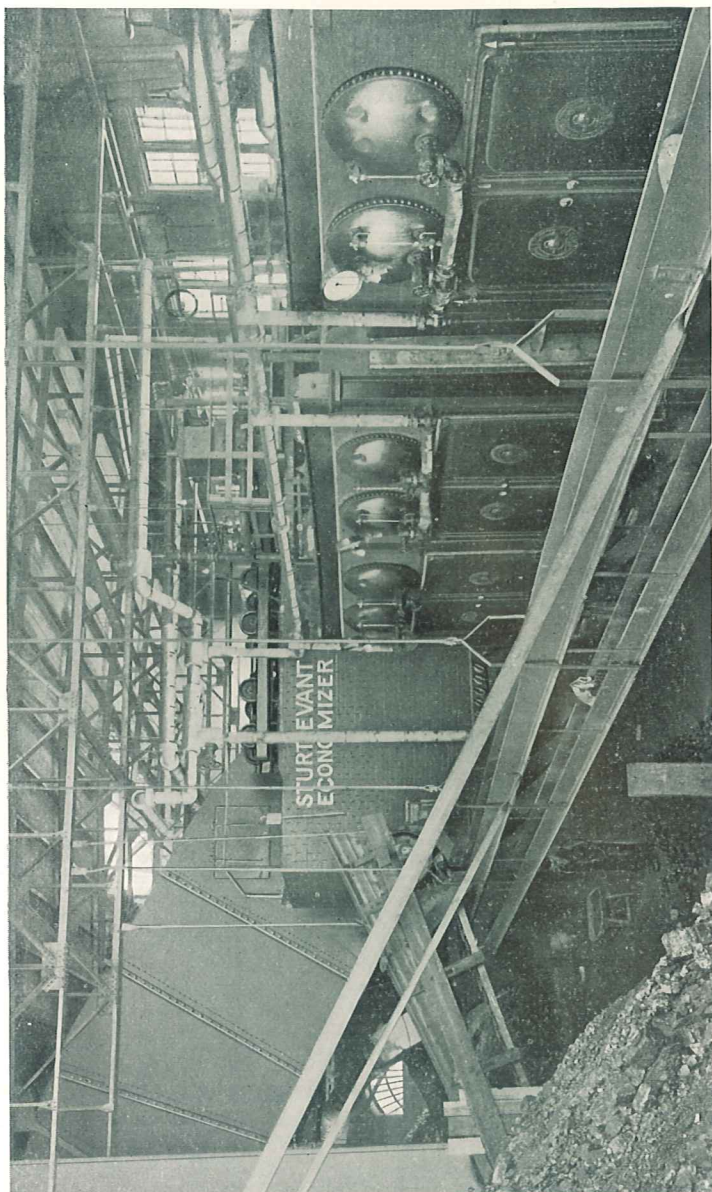
The table below gives results of fourteen miscellaneous Sturtevant Economizer installations showing the amount that the temperature of the gases are reduced while passing through the economizer and the amount that the temperature of the feed water is raised by transferring to it the heat taken from the otherwise wasted gases, and the resulting percentage of fuel saving. The figures on this table taken in connection with the explanation on page 11 will show in a general way the large investment returns that an economizer brings to the average plant.

The theoretical fuel saving when feed water enters at 120° F. and with 150 pounds boiler pressure is 1 per cent in fuel to every 11 per cent temperature rise in the feed water. The percentages of saving as shown in the table below vary from this 11% basis, some being more and some being less, as they are taken from plants with various boiler pressures and different entering temperatures of the feed water.

Item	Gases Entering	Gases Leaving	Water Entering	Water Leaving	Gain in Water	Per Cent Saving	Kind of Draft
1	510	290	130	260	130	12.0	Chimney
2	475	215	71	230	159	13.9	"
3	415	200	100	240	140	12.5	Mechanical
4	525	375	78	198	120	10.5	"
5	500	290	135	240	105	9.8	"
6	575	290	160	320	160	15.3	"
7	667	308	169	269	100	9.6	"
8	480	250	110	260	150	13.7	Chimney
9	600	375	90	230	140	12.5	Mechanical
10	600	350	110	240	130	11.8	Chimney
11	410	204	120	285	165	15.2	Mechanical
12	480	240	90	210	120	10.7	"
13	505	212	84	276	192	17.1	"
14	595	299	130	311	181	16.8	"

The sum of the percentages of fuel saving of the 14 installations divided by 14 gives the average fuel saving of 13%, which is fair and conservative.

$$\begin{array}{r} 14 \overline{) 181.4} \\ 13\% \end{array}$$



ECONOMIZER AT THE J. R. BOOTH COMPANY

STURTEVANT FUEL ECONOMIZERS

RETURN ON INVESTMENT EFFECTED BY AVERAGE ECONOMIZER INSTALLATION

The actual saving which an economizer makes over the interest on the investment plus a fair percentage for depreciation and repairs **INVESTMENT** is a strong factor in determining the advisability **RETURN** of installing an economizer, although in addition to the fuel saving as shown below, there are the advantages of greater boiler capacity and less boiler repairs. Carrying in mind the average fuel saving by actual tests as shown on page 9 as 13 per cent, the following figures will give a fair conservative estimate of the actual investment return of an economizer in the average plant.

Assuming a 1000 H.P. boiler plant operating 10 hours a day at full load with 10 per cent night load, the average coal consumption at 4 pounds per boiler H.P. per hour, the cost of good bituminous coal at \$4.00 per ton, the cost of economizer completely installed at \$5000.

1000 boiler H.P. $\times$ 4 lbs. coal per B.H.P. per hour $\times$ 10 hrs. per day = 40,000 lbs. of coal + 10 per cent night load = 44,000 lbs. of coal used each 24 hours.

44,000 lbs. $\div$ 2240 = 19.64 tons per day $\times$ \$4.00 = \$78.56 fuel cost per day. Average fuel saving by economizer as shown on page 9 being 13 per cent, the return on investment would be as follows:—

13% of \$78.56 daily fuel cost $\times$ 300 days per year	\$3063.84
Interest on investment, depreciation, repairs, etc., at 10%	500.00
Balance	\$2563.84

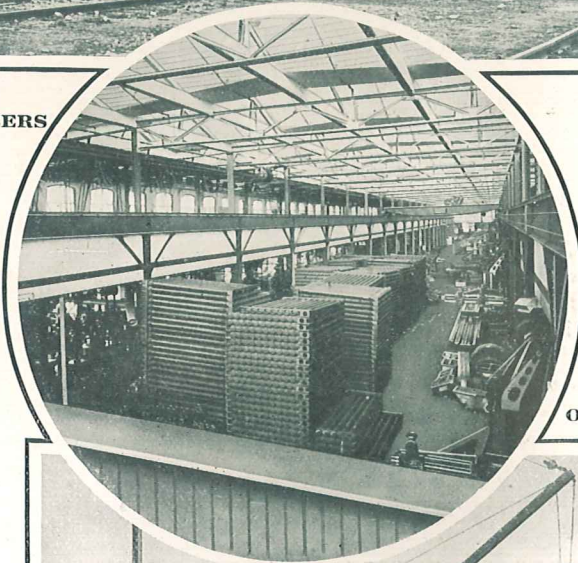
$\$2563.84 \div 5000 = 51.3\%$ annual return on investment.

The type of plant and hours of operation per day have a direct bearing on results, as a plant running twenty-four hours per day **DIFFERENT** as in the case of most paper mills, will give **OPERATING** practically double the investment returns of a **CONDITIONS** plant running ten or twelve hours per day. Thus while the savings of a plant running ten hours a day would take two years to pay for the cost of the economizer, a plant running twenty-four hours a day should pay for the economizer in one year.

Note.—The savings due to the smaller amount of coal handled, lighter load on boilers and purified feed water are in addition to fuel saving as shown above.



**SHIPPING
ECONOMIZERS**



**A SECTION
OF OUR PLANT**



LOADING ECONOMIZERS

STURTEVANT FUEL ECONOMIZERS

STURTEVANT GUARANTEES

Although we subject all our Economizers before they leave our plant to a test by hydraulic pressure much higher than they will ever be subjected to after installation, and furthermore test them again after installation to considerably more than their working pressure, still some purchasers not knowing that our method of testing economizers and our **metal-to-metal** joints practically eliminates the chance of any serious repairs, desire some guarantee on this point. For purchasers desiring this, we have adopted the two following guarantee forms which we have found from past experience that buyers consider very fair and liberal.

On all our economizers we positively guarantee to ship at no charge f.o.b., Readville, any and all parts that prove in any way defective within a period of one year from installation.

**ONE-YEAR
GUARANTEE**

As all parts of our economizer are made to absolute standards, and as we use no rust joints, making the substituting of parts a simple matter, this form of guarantee covers very thoroughly any chances of repairs that may come up for a year from installation.

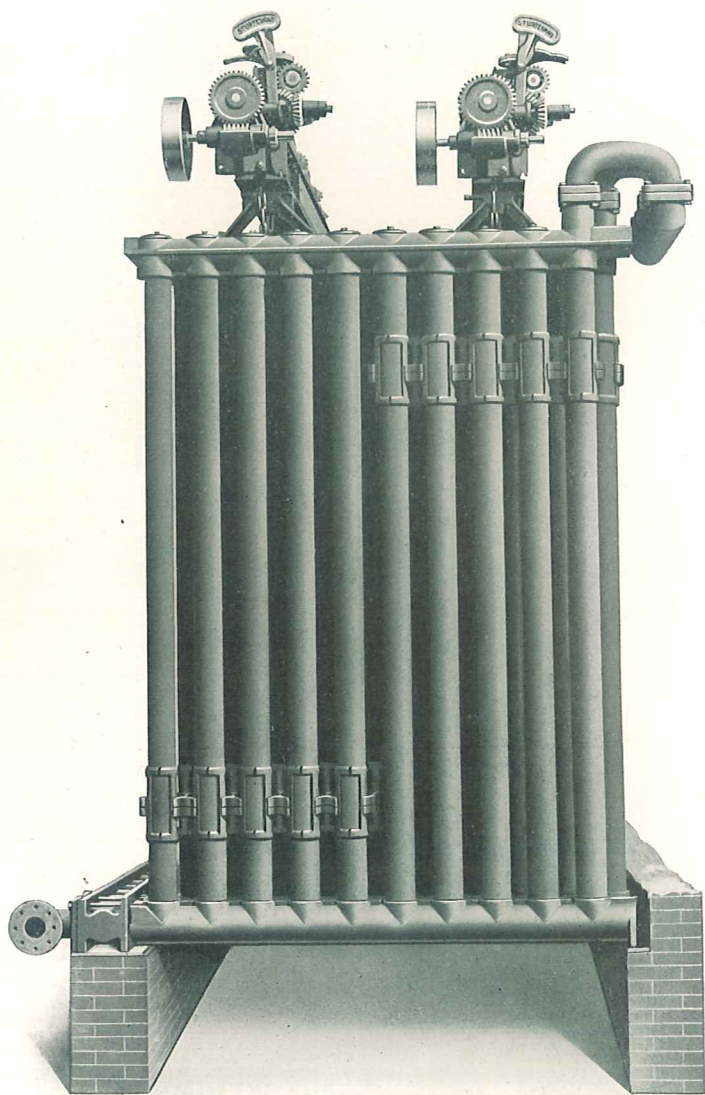
For one per cent per year of the contract price of our economizer

**TEN-YEAR
GUARANTEE**

we will guarantee for ten years to furnish any necessary parts and ourselves make any repairs not due to negligence or wrong use of the apparatus.

This form of guarantee gives a buyer who has never before purchased a Sturtevant Economizer a definite security for a considerable term of years.

Note.—Many of our economizer sales now are to various plants under one ownership where they have already tried out the Sturtevant Economizer and have proved its saving to them and know its strong construction, and so the matter of guarantee is not of much moment to them and often never considered.



**HIGH PRESSURE TYPE. 300 LBS. PRESSURE. ALL JOINTS
METAL-TO-METAL**

STURTEVANT FUEL ECONOMIZERS

WHERE THEY ARE PROFITABLY USED

Economizers are being profitably used in cotton and woolen mills, electric light and railway power plants, steel and wire mills, smelting plants, cement kilns, sulphite fibre plants, brick kilns, and in steam plants of all kinds.

They are used as a hot water supply in laundries, hotels, and dye houses, bleacheries; in fact in all plants where quantities of hot water are needed for manufacturing purposes.

TYPES AND SIZES

We make economizers to suit the requirements of each plant, but they all follow the one general design, and are made in three types: the Standard, the High Pressure, and the Pony economizer.

The Sturtevant Standard Economizer is best adapted for boilers with a capacity of 300 horse power and over, and is made for working pressures of less than 200 pounds per square inch.

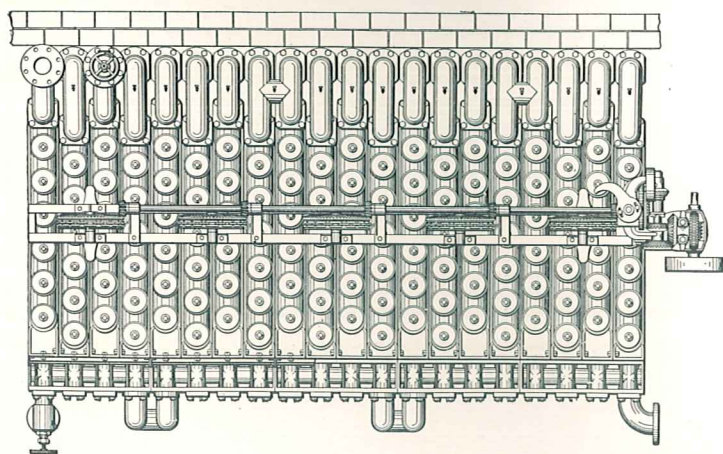
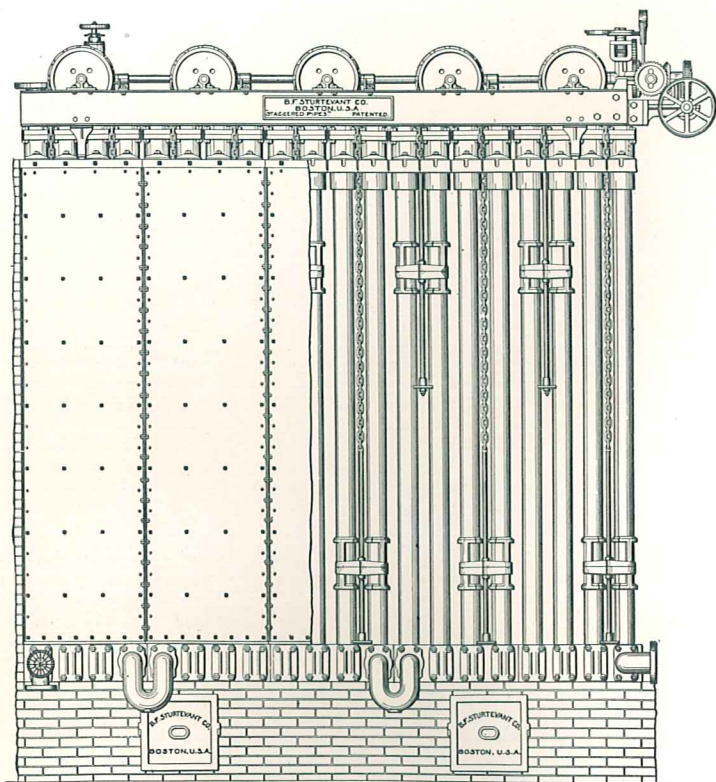
THE STANDARD

The High Pressure type is designed for working pressure of over 200 pounds per square inch. The **metal-to-metal** taper joints are the great point of superiority about the Sturtevant Economizer. When we force these ground taper **metal-to-metal** joints together by hydraulic pressure and test them under higher pressure than they will get in operation, we know that they must stay tight, as there is no gasket to blow or burn out, and there is absolutely no way they can leak.

HIGH PRESSURE

The Pony Economizer is designed for use in plants with less than 350 horse power, and is made only for working pressures of less than 200 pounds. Small steam plants are more and more installing this size economizer, and find its saving pays for the economizer in from one to two years.

THE PONY



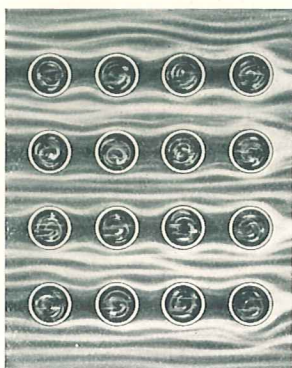
DRAWING OF THE STURTEVANT TYPE M ECONOMIZER

STURTEVANT FUEL ECONOMIZERS

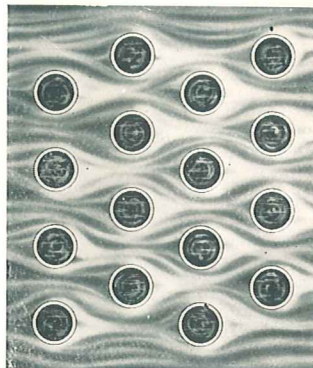
GENERAL DESCRIPTION

The Sturtevant Economizer is made up of cast-iron pipes arranged vertically in rows or sections which are connected by top and bottom cast-iron connecting chambers or headers. The whole apparatus is enclosed in a brick or a metal-asbestos casing, and is so placed in the power plant that all waste gases from the boilers are conducted among and between the economizer pipes in passing to the chimney.

The feed pump supplies water to the economizer pipes, the water entering where the cool gases leave the economizer and leaving where the hottest gases enter (see p. 8), thereby heating the feed water to the highest temperature.



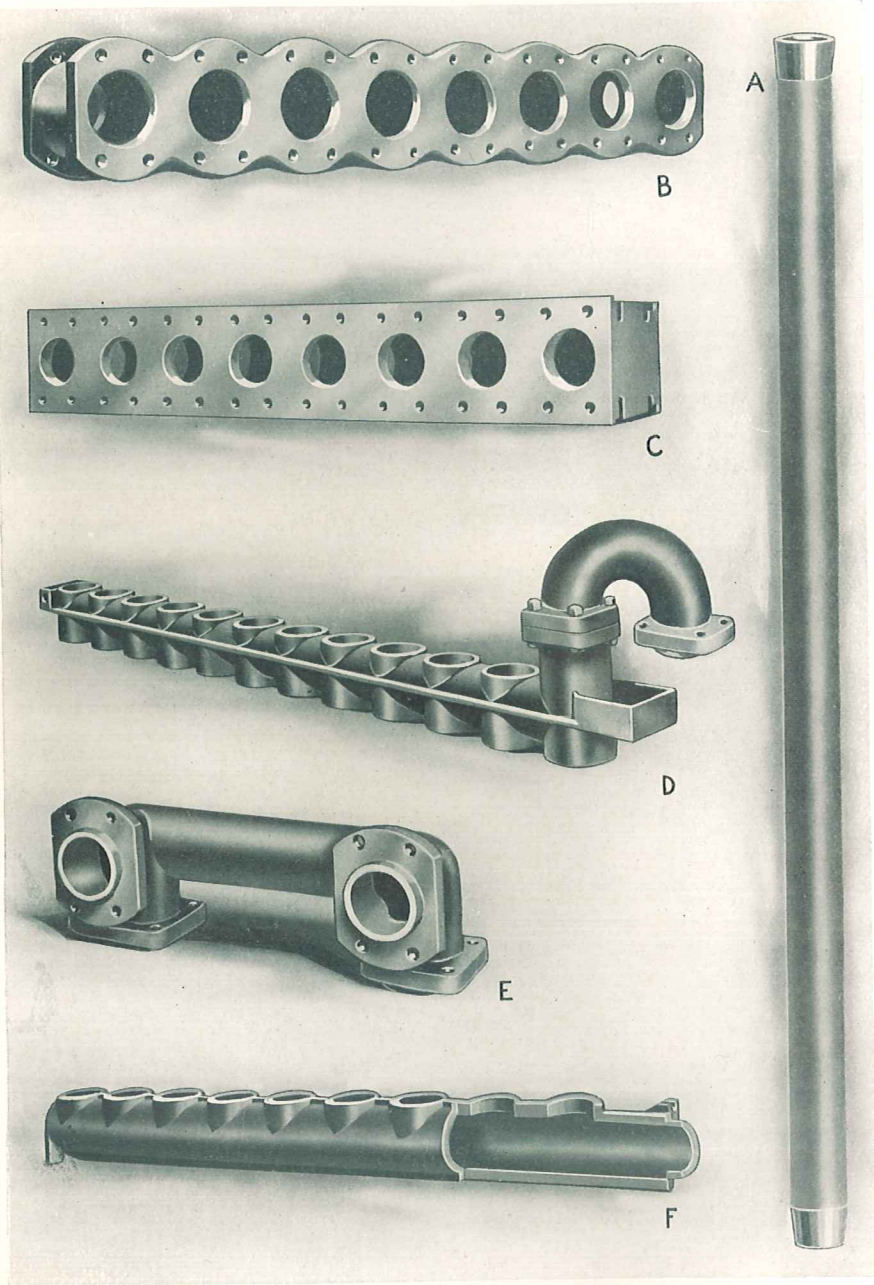
Common Form, Straight Rows



Sturtevant Staggered Pipes
Patented May 26, 1903

The pipes in the Sturtevant Economizer are placed staggered, an arrangement in which the pipes in one section being placed opposite the spaces of the adjacent section, the hot gases must completely envelop the cast iron water pipes and impart their heat to them much more quickly than when passing on the sides only of the parallel rows, as shown by accompanying illustration.

Note.—Although by using the staggered arrangement feed water can be heated to the same temperature with less piping than when the pipes are in straight rows, still since in some instances for special reasons the straight rows are preferred, we build economizers with this pipe arrangement.



PARTS OF HIGH PRESSURE ECONOMIZER

STURTEVANT FUEL ECONOMIZERS

DETAIL CONSTRUCTION

The upright water pipes (Fig. A), $\frac{3}{8}$ inches in thickness, $4\frac{9}{16}$ inches in diameter, and either 9 or 10 feet long according to specifications, are cast of the best tough gray iron. They have accurately machined **metal-to-metal** taper fits at both ends, and are forced by hydraulic pressure into the top and bottom connecting chambers or headers (Figs. D and F), which are so machined as to make an absolutely tight **metal-to-metal** joint without any rusting. This feature of the taper no-rust joint is of great value in case of the necessity of removing a pipe, as shown on pages 22 and 23.

PIPES

In the Sturtevant Economizer the tapers are so designed that a pipe can be withdrawn from the Economizer without chipping and destroying the pipes or headers as is the case in other constructions.

MANIFOLDS

At the top and back of the economizer is a manifold or top connecting chamber (Fig. B) for the different sections. The sections of these manifolds are connected by pipes which allow for expansion and contraction (Fig. E).

The wall box (Fig. C) is a connecting chamber for the different sections at the lower front of the economizer, and, like the manifold at the top, is in

CONNECTIONS

sections connected by "U" joints (Fig. G) to take care of any contraction and expansion. The

wall box, as its name implies, rests on the foundation walls and distributes the weight of the economizer evenly on the foundations.

Over the top of each economizer pipe in the top header is a cap (Fig.

CAPS

H) with a ground **metal-to-metal** joint so constructed that the greater

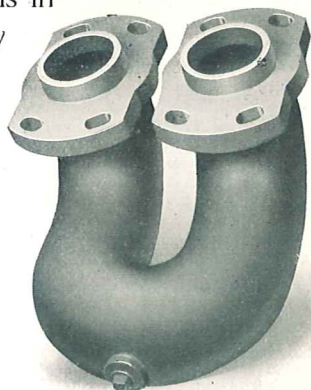
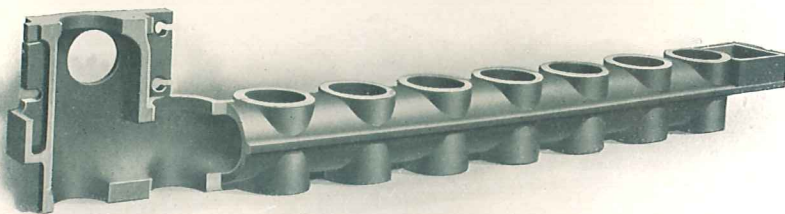
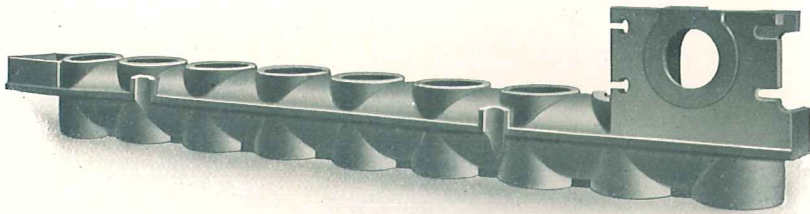
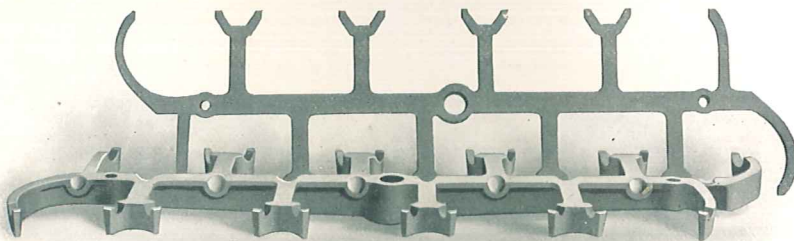


Fig. G



**TYPE OF TOP HEADERS USED IN OUR STANDARD ECONOMIZER
ADAPTED TO PRESSURE UNDER 200 LBS.**



SCRAPER GUARDS AND GUIDE

These guides operated by chains and gears (Fig. K) raise and lower scrapers (Fig. 1). Patented Guide Plate prevents stopping or binding

STURTEVANT FUEL ECONOMIZERS

the pressure in the economizer the tighter the cap fits. In case it is necessary to remove one of the economizer pipes, this cap is taken off and the pipes removed as described on pages 22 and 23.

It is of great importance to keep the economizer pipes clean, as in any

SCRAPERS

economizer a quantity of soot accumulates on the pipes preventing proper transmission of heat. We



Fig. I

Note.—In the Sturtevant Economizer there is no danger of the scrapers stopping. This is an important point, because if the scrapers get stuck the pipes get soot-covered and will not properly transmit the heat to the feed water.

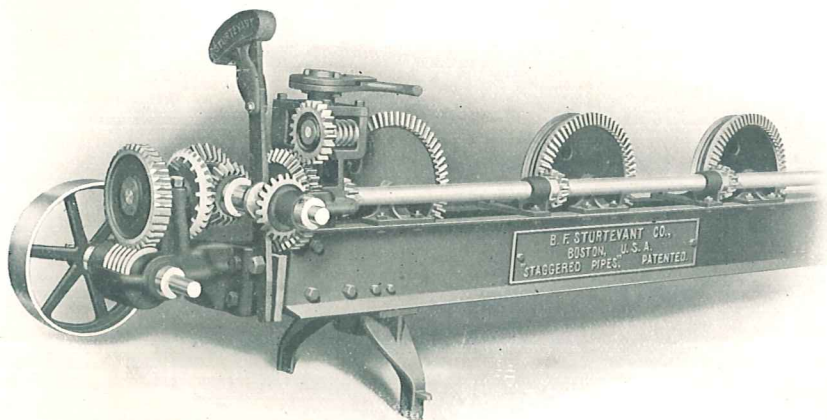


Fig. K

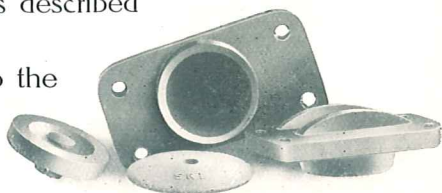
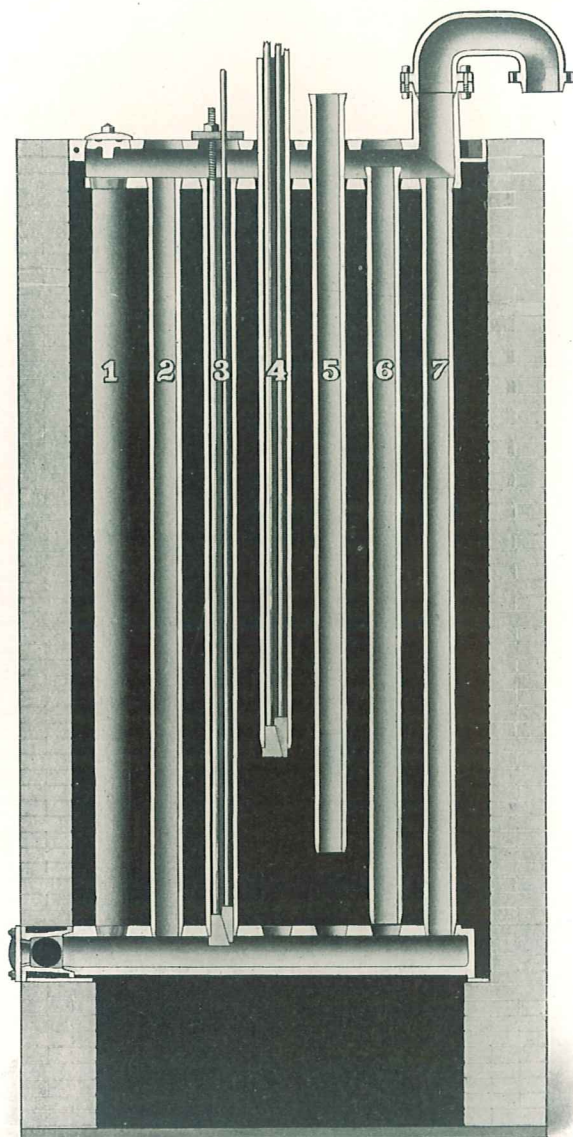


Fig. H



METHOD OF REMOVING PIPES FROM STURTEVANT ECONOMIZER

STURTEVANT FUEL ECONOMIZERS

REPAIRING

Although our economizer is strongly constructed and repairs a small item, yet accidents must be provided for. The ease and simplicity of removing and replacing a pipe is a marked advantage of the Sturtevant Economizer; the whole operation requires but an hour. The **taper metal-to-metal** joints require no packing, cement, or rusting, there is no chipping or damaging the pipes or headers to get any one pipe out.

The taper joints at the top and bottom of the vertical pipes allow easy removal; when inserting a new pipe, tightness is secured by hammering it into good contact. Reference to the illustration on the opposite page will show how easily this substitution is effected.

TAPER JOINTS

Pipe No. 1 is in position with the inside cap in place at top.

Pipe No. 2 is a cross-section of pipe in position with cap removed.

Pipe No. 3 shows draw-out rods in place ready to start pipe from its friction joints. The rod at left with lower end shouldered to fit the pipe is first inserted and held at the top by the nut as shown. The right-hand rod at the same time is introduced as a wedge. By turning the nut on the left-hand rod, the friction joints are released.

Pipe No. 4 shows pipe removed from joints.

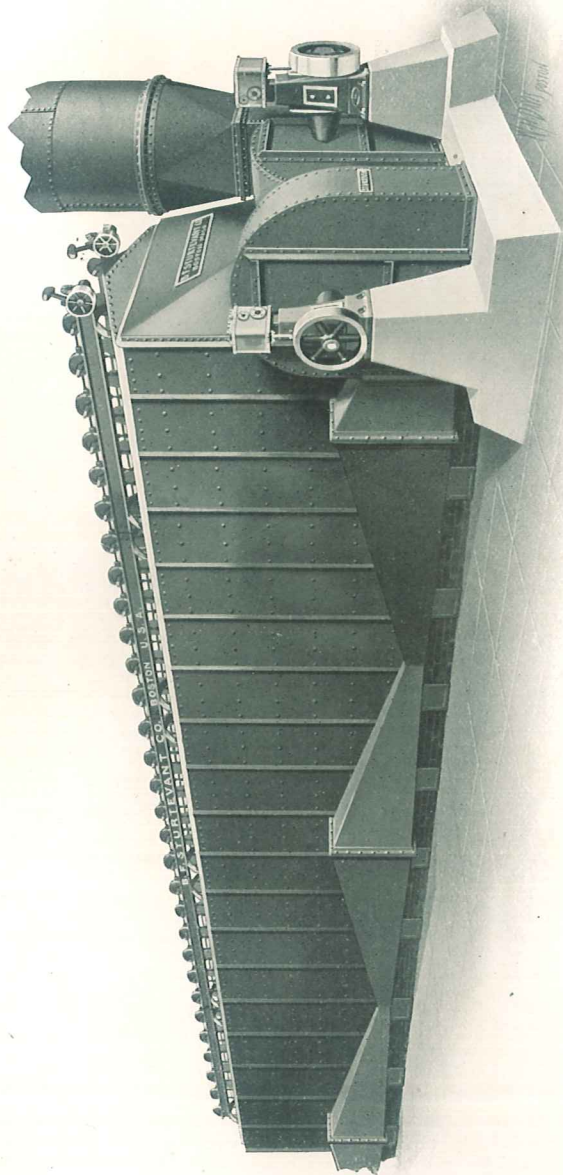
Pipe No. 5 shows the new pipe entering.

Pipe No. 6 is shown ready to enter the tapered seats.

Pipe No. 7 is the new pipe in place.

The Top and Bottom Headers can be readily removed and duplicates inserted without disturbing the other headers, sections, or side walls. There are no branch pipes to take off or replace if a cap, pipe, or section is to be repaired. Any section can be taken out and a duplicate replaced without disturbing the other sections or the side walls. All water surfaces are readily accessible; the caps are the only parts to be removed when cleaning any of the water surfaces.

TOP AND BOTTOM HEADERS



STURTEVANT AIR HEATER

STURTEVANT FUEL ECONOMIZERS

THE STURTEVANT AIR HEATER

For any purpose where extremely hot air, say a temperature of 300° F. or even higher, is desired, the Sturtevant Air Heater is

**PURPOSE
AND USES**

about the only available means of obtaining this result. This system is used for plants doing special drying, baking, and tempering work, in textile mills, hospitals, and in any cases where a large volume of hot air is desired for drying purposes or for heating buildings, etc. It is particularly adapted for installation in laundries, where the regular economizer can be used as a hot water supply and a section of the economizer made as a hot air heater to supply hot air for drying the clothes.

The air heater is on the general principle of the fuel economizer previously described in this catalogue, except that through the econo-

**WORKING
PRINCIPLE**

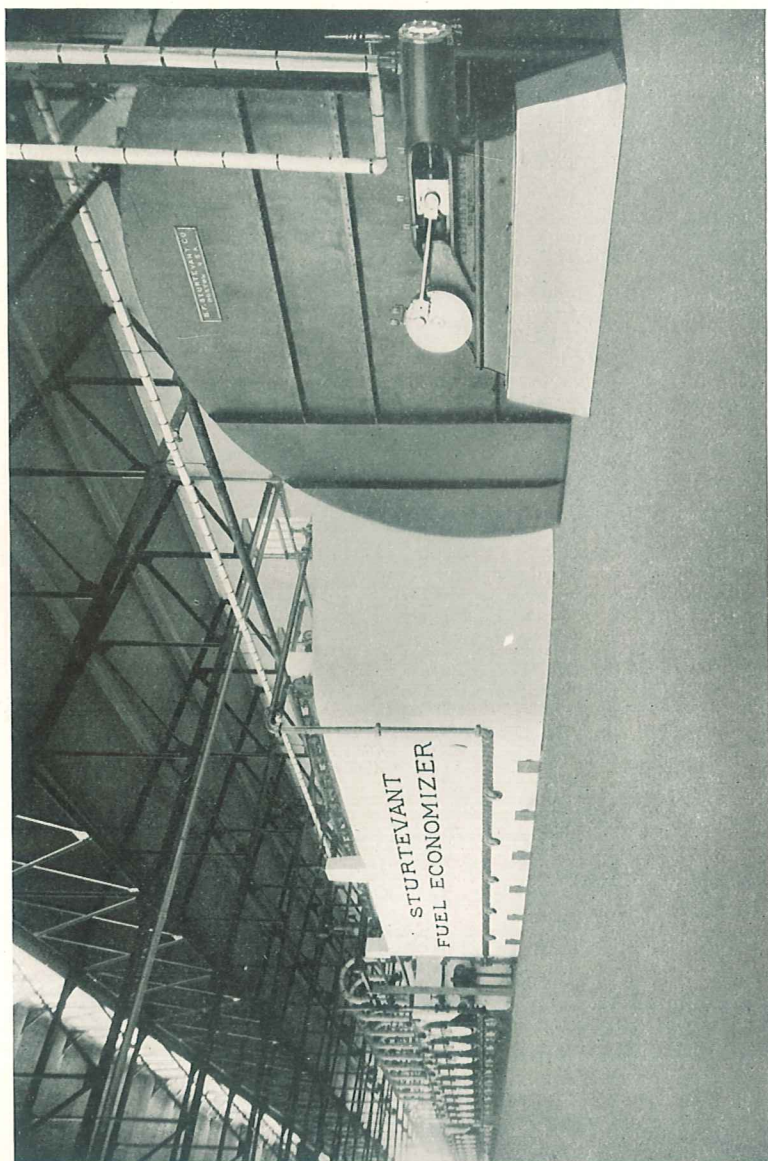
mizer pipes air is forced instead of water, the hot gases from the boilers heating the air circulating in the economizer pipes instead of water as previously described.

In general construction the air heater is like the regular economizer, but there are a few points of special construction, as the headers which are of special form to distribute the proper volume of air to the different pipes. The air is forced

CONSTRUCTION

through the heater by a fan system, as it is better to force air through the pipes rather than to draw it through by exhaust process. The circulation of the air is positive, being forced up and down a given number of sections depending on the volume, and in a course opposite to the direction of the hot gases, thereby obtaining greatest efficiency.

It is not practicable to receive the hot gases into air heaters at a temperature of over 800° or 900° F., as the cast-iron pipes, not being filled by water as in the case of a regular fuel economizer, are liable to be burned out by the excessive heat. It is always possible, however, to dilute any gases desired to be used, thus reducing them to the proper temperature.



ECONOMIZER AT THE WOOD WORSTED MILLS

STURTEVANT FUEL ECONOMIZERS

MECHANICAL DRAFT

Mechanical Draft is produced by a centrifugal fan, and may be applied as Forced or Induced Draft, depending upon conditions. It

WHAT IT DOES does more than an ordinary chimney can do, and its cost is from 20 to 30 per cent of that of the chimney. The intensity of mechanical draft permits the burning of finely divided or low-grade fuel and makes possible the fullest utilizing of the hot flue gases which a chimney wastes in producing drafts. It is independent of the weather; is automatically regulated to maintain constant steam pressure; decreases smoke; increases the capacity of an existing plant, or serves as an auxiliary to a chimney already overburdened.

Forced Draft is particularly applicable to old plants in which increased capacity could otherwise be obtained only by installing

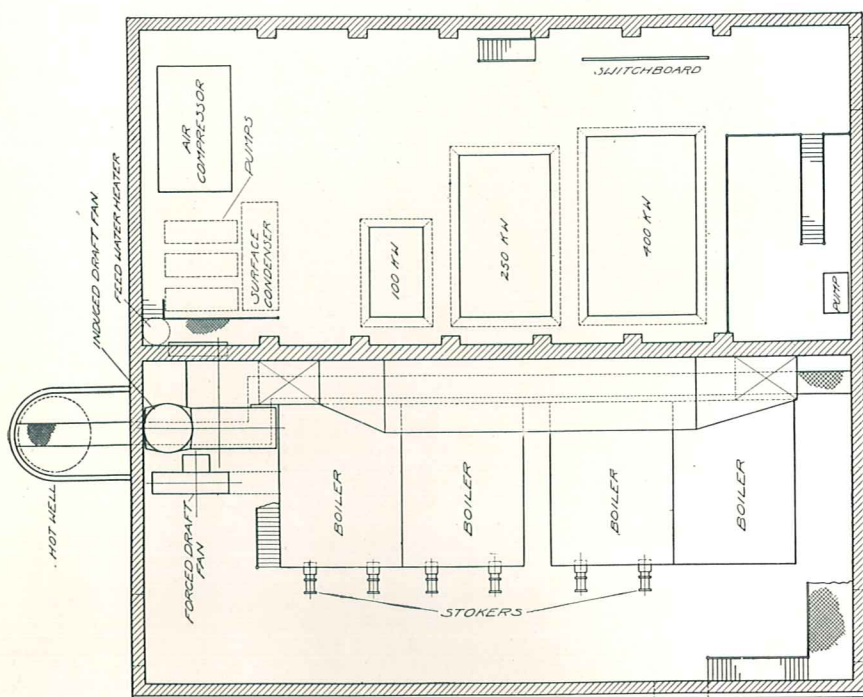
FORCED DRAFT more boilers, increasing the height of the chimney or building a new one. The air, under slight pressure from the fan, is forced through pipes or ducts and discharged into the ash pit through openings in its sides or bottom, thus giving a positive draft which can be regulated as desired.

Induced Draft is so arranged that the gases, after leaving the boilers, are drawn through the fan and a partial vacuum maintained within the boiler furnace, which draws the air from the ash pits

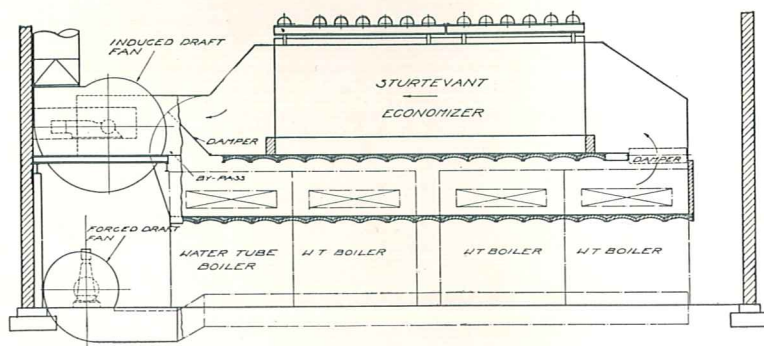
INDUCED DRAFT through the fire beds, giving a positive draft, regulated as desired. As a matter of convenience, the fan is ordinarily installed overhead where it occupies no valuable floor space, and discharges through a short stack extending just above the roof. The shaft runs in water-cooled journal boxes, so that hot gases can be handled without trouble.

Under either system, the fan is usually equipped with direct-connected engine, motor, or turbine automatically regulated to main-

METHOD OF DRIVING tain constant steam pressure. The fan being directly driven permits operating the fan when the remainder of the plant is idle.



PLAN



ELEVATION

TYPICAL LAYOUT OF STURTEVANT ECONOMIZER WITH FORCED AND INDUCED DRAFT

STURTEVANT FUEL ECONOMIZERS

ECONOMIZER WITH MECHANICAL DRAFT

The Sturtevant Economizer and Mechanical Draft each have their value in the operation of a steam plant, as previously shown in this catalogue, and may be successfully applied independently, but for maximum saving and increase of capacity both should be installed.

In any plant the draft must be sufficiently strong, that is, have enough velocity for the air to pass through the fuel bed and supply sufficient oxygen for complete combustion. With natural draft the intensity depends largely upon the temperature of the gases entering the base of the chimney, and since the economizer reduces this temperature, such an installation may have its draft appreciably affected. With the fan blower the draft is entirely independent of the reduction of temperature; in fact, a lower temperature is an advantage, for the volume to be handled is less, therefore all heat possible may be taken from the gases. Although not a necessity when chimney draft is sufficient, yet mechanical draft is better than a chimney when the heat in the waste gases is to be utilized.

The kind of draft to be used is always dependent upon the boiler plant itself. If the draft is insufficient, a fan should be added, and for more boiler capacity and greater fuel economy, both a fan and an economizer are advisable. An economizer without a fan should not be put into a plant having poor draft, but under any conditions the combination of an economizer and mechanical draft may be installed and result in a saving more than sufficient to warrant the investment.

The arrangement of economizers and fans depends upon the location of other apparatus in the plant, the only conditions necessary are that the waste gases pass through the economizer on their way to the chimney, and that the economizer should be placed near the boilers to prevent waste of heat from any unnecessarily long transmission.

STURTEVANT FUEL ECONOMIZERS

SIZES STURTEVANT STANDARD ECONOMIZERS

Height over gearing, 12 ft. 6 in. Height over section, 10 ft, 2¼ in.

Machine Number.	Number of Pipes.	Number of Sections.	No. of Pipes in Section.	External Heating Surface. Sq. ft.	Capacity in Pounds of Water.	GENERAL DIMENSIONS.			
						Length ft. in.	Width with Stan'd Back Side D'mp'rs ft. in.	AREA BETWEEN TUBES Without Side Dampers	With One Side Dampet
1	32	8	4	400	2016	4-10	4-1	16.75	24.00
2	48	12	4	600	3024	7-3	"	"	"
3	64	16	4	801	4032	9-8	"	"	"
4	80	20	4	1001	5040	12-1	"	"	"
5	96	24	4	1201	6048	14-6	"	"	"
6	112	28	4	1401	7056	16-11	"	"	"
7	128	32	4	1601	8064	19-4	"	"	"
8	40	8	5	499	2520	4-10	4-9	19.40	26.65
9	60	12	5	749	3780	7-3	"	"	"
10	80	16	5	999	5040	9-8	"	"	"
11	100	20	5	1248	6300	12-1	"	"	"
12	120	24	5	1499	7560	14-6	"	"	"
13	140	28	5	1747	8820	16-11	"	"	"
14	160	32	5	1997	10080	19-4	"	"	"
15	180	36	5	2247	11340	21-9	"	"	"
16	200	40	5	2496	12600	24-2	"	"	"
17	72	12	6	897	4536	7-3	5-5	22.00	29.30
18	96	16	6	1196	6048	9-8	"	"	"
19	120	20	6	1496	7560	12-1	"	"	"
20	144	24	6	1795	9072	14-6	"	"	"
21	168	28	6	2094	10584	16-11	"	"	"
22	192	32	6	2393	12096	19-4	"	"	"
23	216	36	6	2692	13608	21-9	"	"	"
24	240	40	6	2991	15120	24-2	"	"	"
25	264	44	6	3290	16632	26-7	"	"	"
26	288	48	6	3589	18144	29-0	"	"	"
27	112	16	7	1394	7056	9-8	6-1	24.70	31.95
28	140	20	7	1743	8820	12-1	"	"	"
29	168	24	7	2092	10584	14-6	"	"	"
30	196	28	7	2440	12348	16-11	"	"	"
31	224	32	7	2789	14112	19-4	"	"	"
32	252	36	7	3137	15876	21-9	"	"	"
33	280	40	7	3486	17640	24-2	"	"	"
34	308	44	7	3835	19404	26-7	"	"	"
35	336	48	7	4183	21168	29-0	"	"	"
36	364	52	7	4532	22932	31-5	"	"	"
37	392	56	7	4880	24696	33-10	"	"	"
38	128	16	8	1592	8064	9-8	6-9	27.35	34.60
39	160	20	8	1990	10080	12-1	"	"	"
40	192	24	8	2388	12096	14-6	"	"	"
41	224	28	8	2786	14112	16-11	"	"	"
42	256	32	8	3185	16128	19-4	"	"	"
43	288	36	8	3583	18144	21-9	"	"	"
44	320	40	8	3981	20160	24-2	"	"	"
45	352	44	8	4379	22176	26-7	"	"	"
46	384	48	8	4777	24182	29-0	"	"	"
47	416	52	8	5175	26198	31-5	"	"	"
48	448	56	8	5573	28224	33-10	"	"	"
49	480	60	8	5971	30240	36-3	"	"	"

STURTEVANT FUEL ECONOMIZERS

SIZES STURTEVANT STANDARD ECONOMIZERS

Height over gearing, 12 ft. 6 in. Height over section, 10 ft. 2¼ in.

Machine Number.	Number of Pipes.	Number of Sections.	No. of Pipes in Section.	External Heating Surface. Sq. ft.	Capacity in Pounds of Water.	GENERAL DIMENSIONS.			
						Length ft. in.	Width with Stan'd Back Side D'mpr's ft. in.	AREA BETWEEN TUBES Without Side Dampers	With One Side Damper
50	180	20	9	2237	11340	12— 1	7— 5	30.00	37.25
51	216	24	9	2685	13608	14— 6	"	"	"
52	252	28	9	3132	15876	16— 11	"	"	"
53	288	32	9	3580	18144	19— 4	"	"	"
54	324	36	9	4027	20412	21— 9	"	"	"
55	360	40	9	4475	22680	24— 2	"	"	"
56	396	44	9	4922	24948	26— 7	"	"	"
57	432	48	9	5370	27216	29— 0	"	"	"
58	468	52	9	5817	29484	31— 5	"	"	"
59	504	56	9	6265	31752	33— 10	"	"	"
60	540	60	9	6712	34020	36— 3	"	"	"
61	576	64	9	7160	36288	38— 8	"	"	"
62	200	20	10	2484	12600	12— 1	8— 1	32.65	39.90
63	240	24	10	2981	15120	14— 6	"	"	"
64	280	28	10	3478	17640	16— 11	"	"	"
65	320	32	10	3974	20160	19— 4	"	"	"
66	360	36	10	4471	22680	21— 9	"	"	"
67	400	40	10	4968	25200	24— 2	"	"	"
68	440	44	10	5465	27720	26— 7	"	"	"
69	480	48	10	5962	30240	29— 0	"	"	"
70	520	52	10	6458	32760	31— 5	"	"	"
71	560	56	10	6955	35280	33— 10	"	"	"
72	600	60	10	7452	37800	36— 3	"	"	"
73	640	64	10	7949	40320	38— 8	"	"	"
74	680	68	10	8446	42840	41— 1	"	"	"
75	396	36	11	4915	24949	21— 9	8— 9	35.30	42.55
76	440	40	11	5461	27720	24— 2	"	"	"
77	484	44	11	6008	30497	26— 7	"	"	"
78	528	48	11	6554	33268	29— 0	"	"	"
79	572	52	11	7101	36045	31— 5	"	"	"
80	616	56	11	7646	38811	33— 10	"	"	"
81	660	60	11	8193	41588	36— 3	"	"	"
82	704	64	11	8739	44359	38— 8	"	"	"
83	748	68	11	9286	47136	41— 1	"	"	"
84	792	72	11	9832	49907	43— 6	"	"	"
85	836	76	11	10379	52684	45— 11	"	"	"
86	880	80	11	10925	55455	48— 4	"	"	"
87	528	44	12	6549	33262	26— 7	9— 5	37.95	45.20
88	576	48	12	7145	36289	29— 0	"	"	"
89	624	52	12	7741	39317	31— 5	"	"	"
90	672	56	12	8337	42344	33— 10	"	"	"
91	720	60	12	8933	45371	36— 3	"	"	"
92	768	64	12	9529	48398	38— 8	"	"	"
93	816	68	12	10125	51425	41— 1	"	"	"
94	864	72	12	10721	54452	43— 6	"	"	"
95	912	76	12	11317	57479	45— 11	"	"	"
96	960	80	12	11913	60506	48— 4	"	"	"
97	1008	84	12	12489	63432	50— 9	"	"	"
98	1056	88	12	13065	66357	53— 2	"	"	"

STURTEVANT FUEL ECONOMIZERS

EXPLANATION OF TABLES

The efficiency of any fuel is the amount of heat energy contained in it compared with an established standard which is the heat value of pure carbon, 14,650 British thermal units per pound. Thus, if coal gives out 10,250 B. T. U. per pound, it has an efficiency of 70 per cent. The proportion of this actually transmitted to the water depends upon the efficiency of the boiler. If the above mentioned coal is burned under a boiler having an efficiency of 65 per cent, $.65 \times 10,250 = 6662.5$ B. T. U. will be utilized; the combined efficiency of the boiler and coal will be $\frac{6662.5}{14650}$, or 45.5 per cent. Since 965.7 B. T. U. is the amount of heat necessary to convert one pound of water at 212° F. into steam at atmospheric pressure (see table of Properties of Saturated Steam), the standard fuel will evaporate $\frac{14,650}{965.7} = 15.2$ pounds of water. The coal under consideration will evaporate $\frac{6662.5}{965.7} = 6.9$ pounds of water. These principles are used in calculating the values in the table opposite.

Knowing the temperature of the feed water before it enters an economizer and just as it leaves, the amount of heat imparted to it may be determined directly. If in addition the boiler pressure is considered, the percentage gained is easily calculated or found from the values given in the tables on succeeding pages. The formula for obtaining these values is:

$$\text{Gain in per cent} = \frac{100 (T-t)}{H-t}$$

in which T = heat units in 1 pound of water above zero after heating,
 t = heat units in one pound of water above zero before heating,
 H = heat units in 1 pound of steam at boiler pressure above zero.

STURTEVANT FUEL ECONOMIZERS

EFFICIENCY OF FUELS

British Thermal Units in One Pound of Fuel.	Water Evaporated from and at 212° per Pound of Fuel. Theoretical.	Efficiency of Fuel. Theoretical.	EFFICIENCY OF BOILER.									
			90 PER CENT.		80 PER CENT.		70 PER CENT.		60 PER CENT.		50 PER CENT.	
			Water Evaporated from and at 212° per Pound of Fuel.	Efficiency of Fuel.	Water Evaporated from and at 212° per Pound of Fuel.	Efficiency of Fuel.	Water Evaporated from and at 212° per Pound of Fuel.	Efficiency of Fuel.	Water Evaporated from and at 212° per Pound of Fuel.	Efficiency of Fuel.	Water Evaporated from and at 212° per Pound of Fuel.	Efficiency of Fuel.
14,650	15.2	100.	13.6	90.0	12.1	80.0	10.6	70.0	9.1	60.0	7.6	50.0
14,500	15.0	99.0	13.5	89.0	12.0	79.2	10.5	69.3	9.0	59.4	7.5	49.5
14,250	14.8	97.3	13.3	87.6	11.8	77.8	10.3	68.1	8.9	58.4	7.4	48.7
14,000	14.5	95.6	13.0	86.0	11.6	76.5	10.1	66.9	8.7	57.4	7.3	47.8
13,750	14.2	93.9	12.8	84.5	11.4	75.1	10.0	65.7	8.6	56.3	7.1	47.0
13,500	14.0	92.2	12.6	83.0	11.2	73.8	9.8	64.5	8.4	55.3	7.0	46.1
13,250	13.7	90.5	12.3	81.5	11.0	72.4	9.6	63.4	8.3	54.3	6.9	45.3
13,000	13.5	88.8	12.1	79.9	10.8	71.0	9.4	62.2	8.1	53.3	6.7	44.4
12,750	13.2	87.1	11.9	78.4	10.5	69.7	9.2	61.0	7.9	52.3	6.6	43.6
12,500	12.9	85.4	11.6	76.9	10.3	68.3	9.0	59.8	7.7	51.2	6.5	42.7
12,250	12.7	83.7	11.4	75.3	10.1	67.0	8.9	58.6	7.6	50.2	6.4	41.9
12,000	12.4	82.0	11.2	73.8	9.9	65.6	8.7	57.4	7.5	49.2	6.2	41.0
11,750	12.2	80.3	11.0	72.3	9.7	64.2	8.5	56.2	7.3	48.2	6.1	40.2
11,500	11.9	78.6	10.8	70.7	9.6	62.9	8.4	55.0	7.1	47.2	6.0	39.3
11,250	11.7	76.9	10.5	69.2	9.3	61.5	8.2	53.8	7.0	46.1	5.9	38.5
11,000	11.4	75.2	10.2	67.7	9.1	60.2	8.0	52.6	6.8	45.1	5.7	37.6
10,750	11.1	73.5	10.0	66.2	8.9	58.8	7.8	51.5	6.7	44.1	5.6	36.8
10,500	10.9	71.8	9.8	64.6	8.7	57.4	7.6	50.3	6.5	43.1	5.4	35.9
10,250	10.6	70.0	9.5	63.0	8.5	56.0	7.4	49.1	6.4	42.0	5.3	35.0
10,000	10.4	68.3	9.3	61.5	8.3	54.7	7.2	47.8	6.3	41.0	5.2	34.2
9,750	10.1	66.6	9.1	59.9	8.1	53.3	7.1	46.6	6.1	40.0	5.1	33.3
9,500	9.8	64.9	8.8	58.4	7.9	51.9	6.9	45.4	5.9	38.9	4.9	32.5
9,250	9.6	63.2	8.6	56.9	7.7	50.6	6.7	44.2	5.7	37.9	4.8	31.6
9,000	9.3	61.4	8.4	55.3	7.5	49.1	6.5	43.0	5.6	36.8	4.7	30.7
8,750	9.1	59.7	8.2	53.7	7.3	47.8	6.3	41.8	5.4	35.8	4.6	29.8
8,500	8.8	58.0	7.9	52.2	7.0	46.4	6.2	40.6	5.3	34.8	4.4	29.0

STURTEVANT FUEL ECONOMIZERS

PROPERTIES OF SATURATED STEAM

Total Pressure, in lbs. per Sq. In., Measured from a Vacuum	Temperature, in Degrees Fahrenheit of the Water from which it Was Evaporated	Number of British Thermal Units Contained in One Pound Reckoned from Zero Fahrenheit		Weight of One Cubic Foot of Steam, in Decimals of a Pound	Volume of One Pound of Steam, in Cubic Feet	Relative Volume or Cubic Feet of Steam from one Cubic Foot of Water
		Number Required for Evaporation, Known as Latent Heat, or Heat of Vaporization	Total Number Contained in the Steam			
1	101.84	1034.7	1136.5	.0030	333.10	20750.0
2	126.15	1021.9	1148.1	.0057	173.10	10790.0
3	141.52	1012.2	1153.8	.0084	118.40	7380.0
4	153.00	1005.5	1158.5	.0110	90.40	5630.0
5	162.26	1000.0	1162.3	.0136	73.30	4570.0
6	170.07	995.5	1165.6	.0161	61.90	5855.0
7	176.84	991.4	1168.3	.0186	53.60	3340.0
8	182.86	987.8	1170.7	.0211	47.26	2942.0
9	188.27	984.5	1172.9	.0236	42.36	2640.0
10	193.21	981.4	1174.7	.0260	38.37	2390.0
12	201.95	976.0	1178.1	.0308	32.40	2020.0
14	209.55	971.2	1181.0	.0356	28.03	1746.0
14.7	212.00	965.7	1178.6	.0380	26.36	1644.0
16	216.31	967.0	1183.6	.0404	24.74	1541.0
18	222.40	963.1	1185.9	.0451	22.17	1380.0
20	222.95	959.4	1187.8	.0497	20.09	1250.0
22	233.07	956.0	1189.6	.0544	18.37	1144.0
24	237.82	952.9	1191.3	.0591	16.92	1054.0
26	242.26	949.9	1192.8	.0637	15.70	979.0
28	246.41	947.1	1194.2	.0682	14.67	915.0
30	250.34	944.4	1195.5	.0728	13.74	856.5
32	254.05	941.8	1196.7	.0773	12.93	805.5
34	257.59	939.4	1197.9	.0819	12.21	761.5
36	260.96	937.1	1199.0	.0864	11.58	722.4
38	264.17	934.8	1200.0	.0908	11.01	686.5
40	267.26	932.6	1201.0	.0953	10.47	654.0
42	270.23	930.6	1202.0	.0998	10.02	625.0
44	273.07	928.5	1202.8	.1043	9.589	597.5
46	275.82	926.6	1203.7	.1087	9.195	572.6
48	278.47	924.7	1204.5	.1131	8.838	550.0
50	281.03	922.8	1205.2	.1176	8.507	530.3
52	283.52	921.0	1206.0	.1220	8.198	510.0
54	285.93	919.3	1206.7	.1264	7.912	492.7
56	288.25	917.6	1207.4	.1308	7.647	476.0
58	290.53	915.9	1208.0	.1352	7.397	460.5

STURTEVANT FUEL ECONOMIZERS

PROPERTIES OF SATURATED STEAM—[Concluded]

Total Pressure, in lbs. per Sq. In.,	Temperature, in Degrees Fahrenheit of Steam, etc.	Number of B.T.U., etc.		Weight of One Cubic Foot of Steam, etc.	Volume of One Pound of Steam, in Cubic Feet	Relative Volume or Cubic Feet Steam, etc.
		Number Required for Evaporation	Total Number Contained, etc.			
60	292.74	914.3	1208.7	.1395	7.166	446.5
62	294.88	912.7	1209.3	.1439	6.949	432.5
64	296.97	911.1	1209.8	.1483	6.745	420.0
66	299.02	909.6	1210.4	.1526	6.552	408.0
68	301.01	908.1	1211.0	.1570	6.370	397.0
70	302.96	906.6	1211.5	.1613	6.199	388.0
72	304.86	905.2	1212.0	.1657	6.036	376.0
74	306.72	903.8	1212.5	.1700	5.882	366.8
76	308.54	902.4	1213.0	.1744	5.735	357.4
78	310.33	901.1	1213.5	.1787	5.597	348.5
80	312.08	899.8	1214.0	.1829	5.466	340.5
82	313.79	898.5	1214.4	.1872	5.342	332.8
84	315.47	897.2	1214.9	.1916	5.220	324.7
86	317.12	895.9	1215.3	.1959	5.104	318.0
88	318.73	894.7	1215.7	.2003	4.993	311.3
90	320.32	893.5	1216.2	.2047	4.886	304.5
92	321.88	892.3	1216.6	.2090	4.785	278.2
94	323.41	891.1	1217.0	.2133	4.689	292.0
96	324.91	889.9	1217.3	.2174	4.599	286.4
98	326.40	888.7	1217.6	.2215	4.514	281.0
100	327.86	887.6	1218.1	.2256	4.432	276.2
110	334.83	882.1	1219.7	.2471	4.047	252.0
120	341.31	876.9	1221.2	.2686	3.723	232.0
130	347.38	872.1	1222.7	.2898	3.451	215.0
140	353.09	867.4	1223.8	.3106	3.220	200.8
150	358.50	863.0	1225.0	.3318	3.014	187.9
160	363.62	858.8	1226.1	.3528	2.834	176.7
170	368.50	854.8	1227.2	.3741	2.673	166.5
180	373.16	850.9	1237.1	.3951	2.531	157.7
190	377.61	847.1	1228.9	.4158	2.405	149.8
200	381.89	843.5	1229.8	.4371	2.288	142.6
215	388.02	838.3	1230.9	.4682	2.136	133.0
230	393.80	833.3	1231.9	.4997	2.001	124.8
245	399.32	828.5	1232.9	.5310	1.882	117.3
260	404.55	823.9	1233.7	.5630	1.775	110.6
275	409.57	819.5	1234.6	.5950	1.681	104.8
290	414.35	815.2	1235.3	.6270	1.595	99.5
305	418.97	811.1	1236.0	.6590	1.517	94.6
320	423.40	807.1	1236.6	.6920	1.446	90.1
335	427.67	803.2	1237.2	.7240	1.381	86.2

STURTEVANT FUEL ECONOMIZERS

PERCENTAGE OF SAVING EFFECTED PER DEGREE INCREASE IN FEED WATER

FEED WATER TEMP. F°	BOILER PRESSURE AS SHOWN BY GAUGE												
	85	90	95	100	110	120	130	140	150	160	170	180	200
32	.0846	.0845	.0845	.0844	.0842	.0841	.0840	.0839	.0838	.0837	.0836	.0835	.0833
35	.0848	.0848	.0847	.0846	.0845	.0843	.0842	.0841	.0840	.0840	.0838	.0837	.0836
40	.0852	.0851	.0850	.0850	.0848	.0847	.0846	.0845	.0843	.0843	.0841	.0841	.0839
45	.0855	.0855	.0854	.0853	.0852	.0851	.0849	.0848	.0847	.0846	.0845	.0844	.0843
50	.0859	.0858	.0858	.0857	.0855	.0854	.0853	.0852	.0851	.0850	.0849	.0848	.0846
55	.0863	.0862	.0861	.0861	.0859	.0858	.0857	.0855	.0854	.0853	.0852	.0851	.0850
60	.0867	.0866	.0865	.0864	.0863	.0862	.0860	.0859	.0858	.0856	.0856	.0855	.0853
65	.0870	.0870	.0869	.0868	.0867	.0865	.0864	.0863	.0862	.0861	.0860	.0859	.0858
70	.0874	.0874	.0873	.0872	.0870	.0869	.0868	.0867	.0865	.0864	.0863	.0862	.0860
75	.0878	.0877	.0876	.0876	.0874	.0873	.0872	.0870	.0869	.0868	.0867	.0866	.0865
80	.0882	.0882	.0880	.0879	.0878	.0877	.0875	.0874	.0873	.0872	.0871	.0870	.0868
85	.0886	.0885	.0884	.0883	.0882	.0880	.0879	.0878	.0877	.0876	.0875	.0874	.0873
90	.0890	.0889	.0888	.0887	.0886	.0884	.0883	.0881	.0879	.0878	.0877	.0875	.0873
95	.0894	.0893	.0892	.0891	.0890	.0888	.0887	.0886	.0884	.0883	.0882	.0881	.0880
100	.0898	.0897	.0896	.0895	.0894	.0892	.0891	.0890	.0888	.0887	.0886	.0885	.0883
105	.0902	.0901	.0900	.0899	.0898	.0896	.0895	.0894	.0892	.0891	.0890	.0889	.0888
110	.0906	.0905	.0904	.0903	.0902	.0900	.0897	.0898	.0896	.0895	.0894	.0893	.0891
115	.0910	.0909	.0908	.0907	.0906	.0904	.0903	.0902	.0900	.0899	.0898	.0897	.0896
120	.0914	.0913	.0912	.0911	.0910	.0908	.0907	.0906	.0904	.0903	.0902	.0901	.0899
125	.0918	.0918	.0917	.0916	.0914	.0913	.0911	.0908	.0909	.0907	.0906	.0905	.0904
130	.0923	.0922	.0921	.0920	.0918	.0917	.0915	.0914	.0913	.0912	.0910	.0909	.0907
135	.0927	.0926	.0925	.0924	.0923	.0921	.0920	.0918	.0917	.0916	.0915	.0914	.0912
140	.0931	.0930	.0929	.0929	.0927	.0925	.0924	.0923	.0921	.0920	.0919	.0918	.0916
145	.0936	.0935	.0934	.0933	.0932	.0930	.0928	.0927	.0926	.0924	.0923	.0922	.0922
150	.0940	.0939	.0939	.0937	.0936	.0934	.0933	.0931	.0930	.0929	.0927	.0926	.0924
155	.0945	.0944	.0943	.0942	.0940	.0939	.0937	.0936	.0934	.0933	.0932	.0931	.0929
160	.0949	.0948	.0947	.0946	.0945	.0943	.0942	.0940	.0939	.0937	.0936	.0935	.0933
165	.0954	.0953	.0952	.0951	.0949	.0948	.0946	.0945	.0943	.0942	.0941	.0939	.0939
170	.0958	.0957	.0956	.0955	.0954	.0952	.0951	.0949	.0948	.0946	.0945	.0944	.0941
175	.0963	.0962	.0961	.0960	.0958	.0957	.0955	.0954	.0952	.0951	.0950	.0948	.0946
180	.0968	.0968	.0966	.0965	.0963	.0961	.0960	.0958	.0957	.0955	.0954	.0953	.0951
185	.0972	.0971	.0970	.0969	.0967	.0966	.0964	.0963	.0961	.0960	.0959	.0958	.0956
190	.0977	.0976	.0975	.0974	.0972	.0971	.0969	.0968	.0966	.0964	.0963	.0962	.0960
195	.0982	.0981	.0980	.0979	.0977	.0976	.0974	.0972	.0971	.0970	.0968	.0967	.0965
200	.0988	.0986	.0985	.0984	.0982	.0980	.0979	.0977	.0976	.0974	.0973	.0972	.0969
205	.0992	.0991	.0990	.0989	.0987	.0985	.0983	.0982	.0980	.0979	.0978	.0976	.0975
210	.0997	.0996	.0995	.0994	.0992	.0990	.0988	.0987	.0985	.0984	.0983	.0981	.0979
212	.0999	.0998	.0997	.0996	.0994	.0992	.0990	.0989	.0987	.0986	.0985	.0983	.0981
215	.1001	.1000	.1000	.0999	.0996	.0995	.0993	.0992	.0990	.0989	.0987	.0986	.0984

STURTEVANT FUEL ECONOMIZERS

PERCENTAGE OF SAVING EFFECTED BY HEATING FEED WATER FROM INITIAL TO FINAL TEMPERATURE

BOILER GAUGE PRESSURE 100 POUNDS

Initial Temperature	FINAL TEMPERATURE OF WATER															
	100	120	140	160	180	200	210	220	230	240	250	260	270	280	290	300
60	3.5	5.2	6.9	8.6	10.4	12.1	13.0	13.8	14.7	15.5	16.4	17.3	18.1	19.0	19.8	20.7
80	1.7	3.5	5.2	7.0	8.8	10.5	11.4	12.3	13.2	14.0	14.9	15.8	16.7	17.5	18.4	19.3
100	—	1.8	3.6	5.4	7.1	8.9	9.8	10.7	11.6	12.5	13.4	14.3	15.2	16.1	17.0	17.9
110	—	0.9	2.7	4.5	6.3	8.1	9.0	9.9	10.8	11.7	12.6	13.5	14.4	15.3	16.2	17.1
120	—	—	1.8	3.6	5.5	7.3	8.2	9.1	10.0	10.9	11.8	12.7	13.6	14.5	15.5	16.4
130	—	—	0.9	2.8	4.6	6.9	7.4	8.3	9.2	10.1	11.0	11.9	12.8	13.8	14.7	15.6
140	—	—	—	1.9	3.7	5.6	6.5	7.4	8.4	9.3	10.2	11.1	12.1	13.0	13.9	14.9
150	—	—	—	0.9	2.8	4.7	5.6	6.6	7.5	8.4	9.4	10.3	11.2	12.2	13.1	14.0
160	—	—	—	—	1.9	3.8	4.7	5.7	6.6	7.6	8.5	9.5	10.4	11.4	12.3	13.2
170	—	—	—	—	1.0	2.9	3.8	4.8	5.7	6.7	7.6	8.6	9.5	10.5	11.5	12.4
180	—	—	—	—	—	1.9	2.9	3.9	4.8	5.8	6.8	7.7	8.7	9.7	10.6	11.6
190	—	—	—	—	—	1.0	1.9	2.9	3.9	4.9	5.8	6.8	7.8	8.8	9.7	10.7
200	—	—	—	—	—	—	1.0	2.0	3.0	3.9	4.9	5.9	6.9	7.9	8.9	9.8
205	—	—	—	—	—	—	0.5	1.5	2.5	3.5	4.5	5.5	6.5	7.5	8.5	9.5
210	—	—	—	—	—	—	—	0.9	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0

Note.—The above table is very conservative.

STURTEVANT FUEL ECONOMIZERS

INFLUENCE OF TEMPERATURE UPON CHIMNEY DRAFT

Changes in temperature, of the external atmosphere or the gases in the chimney, have a great influence on the draft, as shown in the table below, in which the draft, indicated in inches of water, is given for a chimney 100 feet high with various internal and external temperatures. For other heights of chimney the height of the water column is directly proportional to that of the chimney, hence doubling the height doubles the draft. The velocity which the draft creates and the corresponding volume of air moved vary as the square root of the height. This table indicates the need of high chimney temperatures for ample draft, and explains the stronger draft which exists in cold weather because of the greater temperature difference.

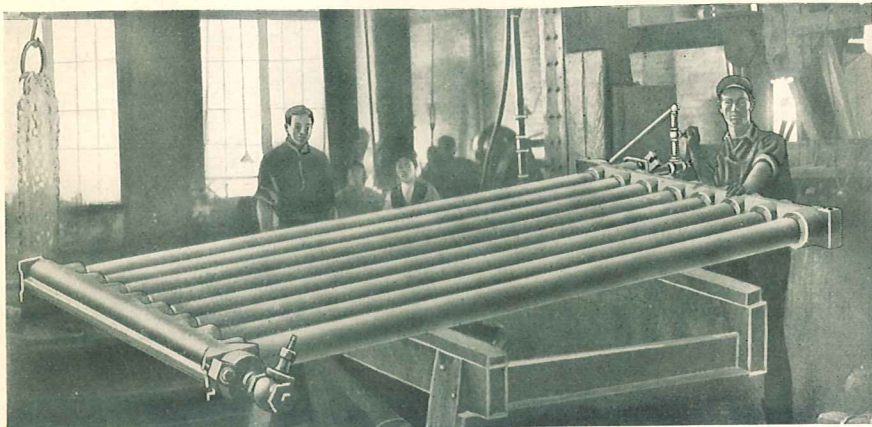
HEIGHT OF WATER COLUMN DUE TO UNBALANCED PRESSURES IN CHIMNEY 100 FEET HIGH

Temperature in Chimney.	Temperature of External Air. (Barometer 14.7 lbs.)										
	0°	10°	20°	30°	40°	50°	60°	70°	80°	90°	100°
200°	.453	.419	.384	.353	.321	.292	.263	.234	.209	.182	.157
220	.488	.453	.419	.388	.355	.326	.298	.269	.244	.217	.192
240	.520	.488	.451	.421	.388	.359	.330	.301	.276	.250	.225
260	.555	.528	.484	.453	.420	.392	.363	.334	.309	.282	.257
280	.584	.549	.515	.482	.451	.422	.394	.365	.340	.313	.288
300	.611	.576	.541	.511	.478	.449	.420	.392	.367	.340	.315
320	.637	.603	.568	.538	.505	.476	.447	.419	.394	.367	.342
340	.662	.638	.593	.563	.530	.501	.472	.443	.419	.392	.367
360	.687	.653	.618	.588	.555	.526	.497	.468	.444	.417	.392
380	.710	.676	.641	.611	.578	.549	.520	.492	.467	.440	.415
400	.732	.697	.662	.632	.598	.570	.541	.513	.488	.461	.436
420	.753	.718	.684	.653	.620	.591	.563	.534	.509	.482	.457
440	.774	.739	.705	.674	.641	.612	.584	.555	.530	.503	.478
460	.793	.758	.724	.694	.660	.632	.603	.574	.549	.522	.497
480	.810	.776	.741	.710	.678	.649	.620	.591	.566	.540	.515
500	.829	.791	.760	.730	.697	.669	.639	.610	.586	.559	.534

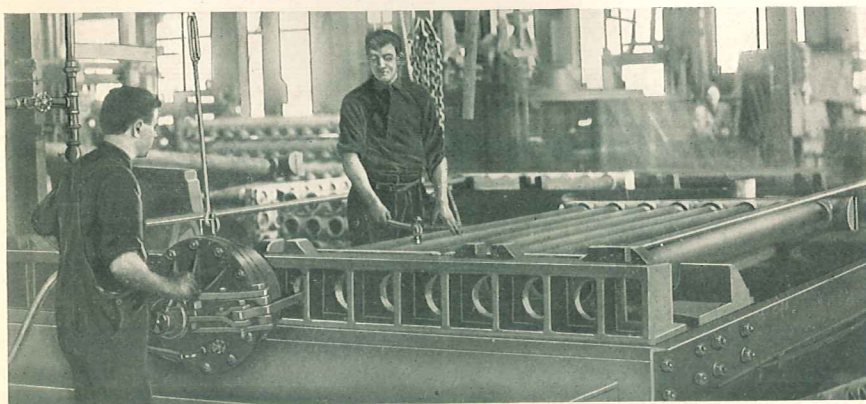
STURTEVANT FUEL ECONOMIZERS

CAPACITY OF CHIMNEYS — KENT'S FORMULA

HEIGHT OF CHIMNEY IN FEET																											
Dia. in Inches	100	105	110	115	120	125	130	135	140	145	150	155	160	165	170	175	180	185	190	195	200	225	250	275	300	Dia. in Inches	
COMMERCIAL HORSE POWER																											
48	348	356	365	373	381	389	396																			48	
54	449	461	472	482	493	503	513	523	532	542																54	
60	565	579	593	606	619	632	644	657	669	680	692	704	715													60	
66	694	711	728	744	760	776	791	806	821	835	849	864	877	891	904	918										66	
72	835	856	876	896	913	934	952	970	988	1006	1023	1040	1056	1073	1089	1105	1120	1136	1151							72	
78	1014	1038	1062	1084	1107	1129	1150	1171	1192	1212	1232	1252	1272	1291	1310	1328	1346	1364	1382	1400	1485					78	
84		1214	1241	1268	1294	1320	1345	1370	1394	1418	1441	1464	1487	1509	1531	1553	1574	1595	1616	1637	1736	1830	1919	2005		84	
90			1435	1466	1496	1526	1555	1584	1612	1639	1666	1693	1719	1745	1771	1795	1820	1845	1869	1893	2008	2116	2217	2318		90	
96			1643	1678	1713	1747	1780	1813	1845	1876	1907	1938	1968	1998	2027	2056	2084	2112	2140	2167	2298	2423	2542	2654		96	
102			1905	1944	1983	2021	2058	2094	2130	2165	2200	2234	2268	2301	2333	2366	2397	2429	2459	2609	2750	2884	3012			102	
108			2190	2234	2276	2318	2359	2399	2439	2478	2516	2554	2592	2628	2664	2700	2736	2771	2939	3098	3248	3393				108	
114			2499	2547	2594	2640	2685	2729	2773	2816	2858	2900	2941	2982	3022	3061	3100	3288	3466	3635	3797					114	
120			2833	2885	2936	2986	3036	3084	3132	3179	3226	3271	3316	3361	3405	3448	3557	3657	3855	4040	4223					120	
126			3191	3248	3305	3359	3412	3465	3518	3568	3620	3670	3720	3770	3818	4048	4268	4473	4672							126	
132			3576	3637	3697	3756	3815	3872	3929	3984	4039	4093	4147	4200	4455	4696	4926	5144								132	
138				3822	3885	3947	4009	4068	4127	4188	4243	4300	4357	4414	4680	4935	5178	5407								138	
144					4424	4495	4565	4632	4701	4768	4834	4899	4963	5026	5331	5618	5892	6155								144	
156						5300	5381	5465	5545	5625	5700	5780	5850	5925	6282	6622	6950	7260								156	
168							6270	6365	6458	6550	6640	6725	6815	6900	7320	7720	8090	8450								168	
180															7330	7440	7540	7645	7750	7850	8430	8890	9320	9740		180	



TESTING ASSEMBLED SECTION WITH HYDRAULIC PRESSURE



FORCING PIPES INTO HEADERS BY HYDRAULIC PRESSURE

